

### Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (currently amended) A method for improving a thermal barrier coating comprising:

providing a substrate;

providing a bond coat composed substantially ~~only~~ of nanocrystalline MCrAlY without inclusion of other metallic alloys, where M is comprised of at least one of the group of ~~stands for either~~ Co, Ni and/or Fe, using a thermal spray process onto a metallic substrate; and

providing a ceramic top coat on the nanocrystalline bond coat.

2. – 10. (cancelled)

11. (currently amended) The method of claim 1 where providing the ~~nanocrystalline, nano-composite~~ bond coat on the substrate comprises providing a nanocrystalline alumina coating by cryomilling an alumina powder to achieve nanocrystalline grain sizes and disposing the cryomilled nanostructured alumina composite coating on a bond coat on the substrate.

12. (original) The method of claim 11 where disposing the alumina powder on the bond coat comprises plasma spraying the nanocrystalline alumina powder onto the bond coat in the presence of oxygen.

13. (currently amended) A thermal barrier coating comprising:

a substrate;

a bond coat substantially ~~only~~ composed of nanocrystalline MCrAlY without inclusion of other metallic alloys, where M is comprised of at least one of the group of ~~stands for either~~ Co, Ni and/or Fe, using a high velocity oxy fuel (HVOF) thermal spray process or low pressure plasma (LPPS) spray process onto ~~a metallic substrate on the~~ substrate; and

a ceramic top coat on the ~~nanostructured, nano-composite~~ bond coat.

14. – 24. (cancelled)

25. (currently amended) A method for improving a MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

providing a MCrAlY bond coat on a substrate; and

providing a nanocrystalline nano-composite coating on the MCrAlY bond coat without inclusion of other metallic alloys with a where the nanostructured nano-composite bond coating is prepared only by refining the microstructure of the a MCrAlY powder used to make the nanostructure nano-composite coating to nanocrystalline grain size.

26. (cancelled)

27. (currently amended) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder ~~during which the microstructure of the MCrAlY powder is refined to~~ nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

28. (original) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size during cryomilling through the introduction of  $\text{Al}_2\text{O}_3$  particles during cryomilling.

29. (original) The method of claim 28 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size during cryomilling comprises introducing nano alumina particles during cryomilling.

30. (previously amended) The method of claim 28 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size achieved after cryomilling comprises introducing nano alumina whiskers during cryomilling.

31. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a MCrAlY bond coat on a substrate; and

a nanostructured nano-composite bond coat with nanocrystalline size MCrAlY grains without inclusion of other metallic alloys on the MCrAlY bond coat on the a substrate.

32. (cancelled)

33. (original) The thermal barrier coating of claim 31 where the nanocrystalline size MCrAlY grains are formed by cryomilling the MCrAlY powder during which the microstructure of the MCrAlY powder is refined to nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

34. (currently amended) The thermal barrier coating of claim 31 where the ~~powder~~ nanocrystalline size MCrAlY grains are formed by cryomilling ~~the~~ MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size after cryomilling through the introduction of Al<sub>2</sub>O<sub>3</sub> particles during cryomilling.

35. (original) The thermal barrier coating of claim 34 where the nanocrystalline size MCrAlY grains formed after cryomilling arise from nano alumina particles introduced during cryomilling.

36. (previously amended) The thermal barrier coating of claim 34 where the nanocrystalline size MCrAlY grains formed achieved after cryomilling arise from nano alumina whiskers introduced during cryomilling.
37. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:
- a substrate;
  - a ~~fully~~-nanocrystalline MCrAlY bond coat on the substrate without inclusion of other metallic alloys; and
  - a ceramic top coat on the fully nanocrystalline bond coat.
38. (previously presented) The MCrAlY thermal barrier coating of claim 37 further comprising an Al<sub>2</sub>O<sub>3</sub> nanoparticle additive disposed throughout the fully nanocrystalline MCrAlY bond coat which Al<sub>2</sub>O<sub>3</sub> nanoparticle additive was added during cryomilling of the MCrAlY powder.
39. (previously presented) The MCrAlY thermal barrier coating of claim 38 where the Al<sub>2</sub>O<sub>3</sub> nanoparticle additive was introduced as Al<sub>2</sub>O<sub>3</sub> powder added during cryomilling of the MCrAlY powder.
40. (previously presented) The MCrAlY thermal barrier coating of claim 38 where the Al<sub>2</sub>O<sub>3</sub> nanoparticle additive was introduced as Al<sub>2</sub>O<sub>3</sub> whiskers added during cryomilling of the MCrAlY powder.

41. and 42. (cancelled)

43. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;

a fully-nanocrystalline MCrAlY bond coat without inclusion of other metallic alloys on the substrate;

a ceramic top coat on the fully-nanocrystalline bond coat; and

an Al<sub>2</sub>O<sub>3</sub> nanoparticle additive disposed throughout the fully-nanocrystalline MCrAlY bond coat which Al<sub>2</sub>O<sub>3</sub> nanoparticle additive was added during cryomilling of the a MCrAlY powder from which the nanocrystalline MCrAlY bond coat was formed.

44. (cancelled)

45. (currently amended) The method of claim 43 44-where the MCrAlY powder from which the nanocrystalline MCrAlY bond coat was formed was cryomilled ~~cryomilling a MCrAlY powder at low speed comprises cryomilling with a model 1-S attritor or~~ equivalent.